## REMARKS

### Specification

The amendment filed January 7, 2005 was objected to because it allegedly introduces new matter.

Accordingly, relevant portions have been amended into the original expression. Thus, the objection has been overcome.

### Rejections under 35 USC §112, Second Paragraph

Claims 1 and 2 were rejected under 35 USC §112, second paragraph, as being indefinite.

Accordingly, claims 1 and 2 have been amended to recite "single-crystal of zinc-manganese oxide" to overcome the rejection.

### Rejections under 35 USC §103(a), Second Paragraph

Claims 1-4 were rejected under 35 USC §103(a), as being unpatentable over Schetzina (U.S. Patent No. 5,679,965) in view of White et al (U.S. Patent No.6,291,085) and Fujimura et al (*Exotic Doping For ZnO Thin Films: Possibility of Monolithic Optical Integrated Circuit*). In so doing, the Examiner alleged that it would have been obvious to modify Schetzina's single crystalline ZnO layer by doping with p-type dopant, as taught by White et al, because a p-type ZnO layer is useful as a light emitting diode and has a lower resistivity.

Schetzina discloses an integrated heterostructure of Group III-V nitride semiconductor materials including epitaxial ohmic contact, non-nitride buffer layer and a method of making the integrated heterostructure. As the Examiner admits, Schetzina does not teach a p-type dopant selected from the group consisting of C, N, and oxide thereof. Moreover, Schetzina does not teach or suggest doping of manganese in the zinc oxide. Furthermore, Schetzina describes as follows:

> Most preferably, according to the present invention, buffer layer 134 comprises a layer of monocrystalline zinc oxide that is typically 20 Å to 30,000 Å thick. In particular, zinc oxide has several desirable properties for use as a compliant buffer layer between base substrate 132 and the III-V nitride integrated heterostructure device of FIG. 3 comprised of layers 120b, 110, and 120a. Zinc oxide has a hexagonal crystal structure with lattice constants (c=5.213 angstroms, a=3.249 angstroms) and thermal expansion coefficients ($\Delta a/a$=4.8.times.$10^{-6}$ at 300 °K; $\Delta a/a$=8.3x$10^{-6}$ at 800°K.) comparable to those of the III-V nitrides. Its band gap at 300°K. is 3.3 eV. Although zinc oxide is softer than the III-V nitrides, it is one of the most tightly bound of the wide-band-gap II-VI materials. As a consequence, it has a very high melting point (1975°C) and its surface is stable with respect to sublimation at temperatures up to at least 900°C. High-quality bulk crystals of zinc oxide are not currently available. In addition, because of its high sublimation and melting temperatures, sputtering is currently the preferred technique to prepare zinc oxide films for use in transparent conductor applications.

(col. 18, lines 39-59). Thus, zinc oxide is used as a buffer layer, but Schetzina does not discuss ferromagnetism at all.

On the other hand, White et al discloses a zinc oxide film containing p-type dopant and process of preparing the zinc oxide film. The zinc oxide films are discussed for use in LEDs, LDs, FETs and photodetectors (Col. 1, lines 11-20). White et al describes as follows:

> In a particularly preferred embodiment of the present invention, the target 18 is polycrystalline ZnO, the substrate 12 is gallium arsenide, and the p-type dopant is arsenic. If the growth of the ZnO film on the gallium arsenide substrate as described above occurred at a temperature of at least about 400°C, no further processing steps are necessary, and the ZnO layer will contain a net acceptor concentration of at least about $10^{15}$ acceptors/$cm^3$, preferably between about $10^{18}$ and about $10^{21}$ acceptors/$cm^3$ as arsenic atoms will migrate from the gallium arsenide substrate into the ZnO film during the film growth at a temperature of at least about 400°C. Additionally, the film will have a resistivity of no more than about 1 ohm-cm, preferably between about 1 and about $10^{-4}$ ohm-cm, and a Hall mobility of between about 0.1 and about 50 $cm^2$/Vs.

(Col. 5, lines 46-60). Nothing indicates the applicability of Schetzina. Thus, there is no teaching or suggestion to combine Schetzina's single crystalline ZnO layer with doping discussed in White et al. Moreover, White et al does not discuss ferromagnetism at all.

Fujimura et al discusses exotic doping for ZnO thin films and describes that "Mn can be dissolved in ZnO matrix for doping below 1 at%." Claims 1 and 2 have been amended to recite "5.2 to 99 mol% manganese." Fujimura et al does not teach or suggest the zinc oxide material contains 5.2 to 99 mol% manganese. According to the present invention, as shown in Table 1 in

the present specification, the ferromagnetic p-type single-crystal zinc-manganese oxide material has high ferromagnetic transition temperature of 150 °K or more.

Moreover, Fujimura et al does not discuss ferromagnetism. In Fujimura et al, Fig. 4 on page 320 does not show hysteresis, which indicates ferromagnetism. "RESISTIVITY CONTROL" at page 321 discusses n-type ZnO and p-type ZnO without mentioning ferromagnetism. The present invention realizes ferromagnetism by doping manganese into p-type doped ZnO. ZnO does not exhibit ferromagnetism by doping manganese without p-type doping.

**Double Patenting**

Claims 1 and 2 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,527,858 in view of Fujimura et al.

Claims 3 and 4 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,527,858 in view of Fujimura et al, and further in view of Schetzina (U.S. Patent No. 5,679,965).

The double patenting rejections have been overcome by the new terminal disclaimer attached hereto. The previously filed terminal disclaimer was rejected because the filing receipt indicates that the Power of Attorney is associated with a law firm with Customer Number 23850, which no longer is in charge of the present application. The assignee files an executed

Revocation of Power of Attorney and Statement Under 37CFR§3.73(b) so that the power of attorney correctly reflects our Customer Number 38834.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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